

*TAS Energy Inc.*

# Generation Storage: Integrating Renewables with California's Hidden, Flexible, Peak Capacity

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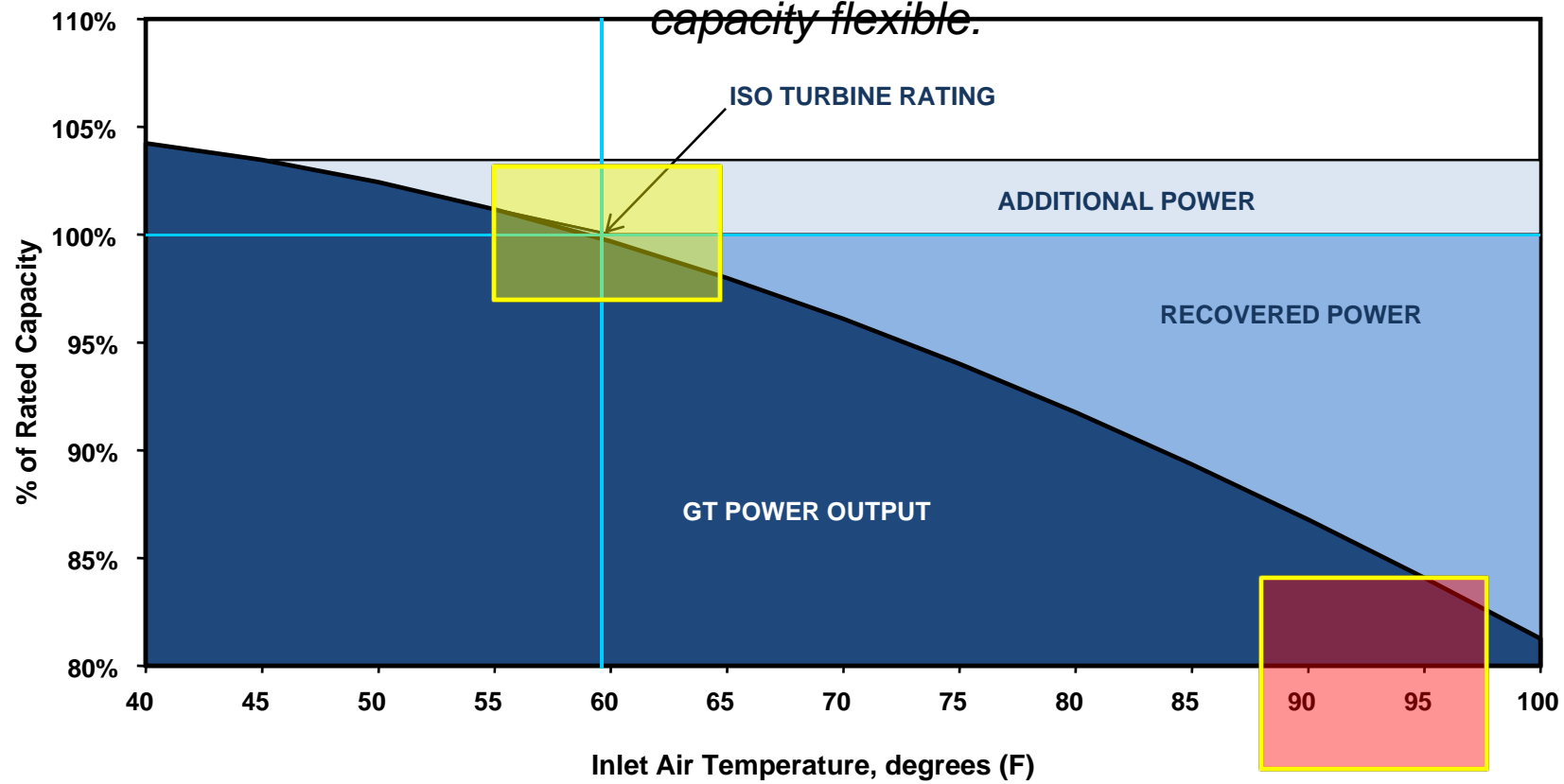
**California has around ~1,500 additional MWs hidden within its combined cycle gas fleet that can be tapped for the lowest cost, instant reg up/reg down peak power to assist in integrating renewables**

- Total install cost of only \$250-\$300/kw for new builds and \$350-\$450/kw for retrofits (compared to \$1,000+/kw for a traditional peaker)
- MWs generated at combined cycle efficiency levels
- Proven technology: ~400 turbines around the world have been chilled
- Can be up and running in 9-12 months
- Flexible, dispatchable power in 40-80MW increments, an alternative to new peaking plants
  - 1/3 the cost, ½ the emissions, no new transmission and no additional maintenance requirements

# INCREASED FLEXIBLE MWs WITH VARIABLE AIR TEMPERATURE



*Gas turbines lose up to 20% capacity with hotter temperatures.  
The time of highest demand is the time the gas turbines produce  
the least capacity.  
Chilling provides 20% more peak capacity, storage makes that  
capacity flexible.*



# GENERATION STORAGE

1. Off-peak power is used to chill water (can be wind power)
2. Energy is stored in the form of chilled water
3. The following day the water chills the inlet air of the turbine to precisely the temperature needed for desired GT output. This increases the capacity of peak time power by up to 20%. The storage component provides almost instantaneous, grid dispatchable, regulation up/down capability (under two minutes) through pump speed adjustment which adjusts inlet air temperature to modulate output



- A separate contract needs to be available for IPPs to bid the new flexible capacity into an RFO on top of current contract
  - Currently, it is unclear whether facilities currently under contract would receive compensation for added flexible capacity
- All RFO's need to include the opportunity for Generation Storage retrofits to bid against 'new steel in the ground'
- Generation Storage should be evaluated as an alternative to all new peaking projects before the CEC

- ~1,500<sup>+</sup> MWs of additional flexible capacity available from current combined cycle fleet (higher efficiency than traditional peaking units could provide)
- Total install cost of only \$250-\$300/kw for new builds and \$350-\$450/kw for retrofits (compared to ~\$1,000/kw for new generation)
- Generation Storage on existing combined cycles offers a first alternative to new generation
  - No new transmission required
  - 9-12 months to operation
  - Greater than 100% efficiency on energy storage
  - Flexible MWs offered at combined cycle efficiency
  - Proven technology, hundreds installed around the world
  - 1/3 the cost of a new peaker
  - ½ to 1/3 the CO<sub>2</sub> emissions of a new peaker
  - ½ to 1/3 the total regulated emissions of a new peaker

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